What is claimed is:

1. A process for depositing a thin film on the surface of a substrate by a sequential process including one or more cycles, wherein at least one cycle comprises:

exposing the substrate to a vapor of a first material containing at least two elements of the thin film, wherein at least a portion of the first material's vapor adsorbs on the surface of the substrate by a self-limiting process;

removing un-adsorbed vapor of the first material from the vicinity of the substrate;

exposing the substrate to the vapor of a second material that activates the surface so that the surface is prepared to react with additional quantities of said first material, said activation characterized in that elements of the second material are not incorporated into the thin film; and

removing residual vapor of the second material from the vicinity of the substrate.

2. A process as in claim 1 for forming a thin film comprising tungsten and nitrogen.

3. A process for depositing a thin film on the surface of a substrate by a sequential process including one or more cycles, wherein at least one cycle comprises:

exposing the substrate to a vapor of a first material comprising an element selected from the group consisting of tungsten and molybdenum and containing at least two elements of the thin film, wherein at least a portion of the first material's vapor adsorbs on the surface of the substrate by a self-limiting process;

removing un-adsorbed vapor of the first material from the vicinity of the substrate;

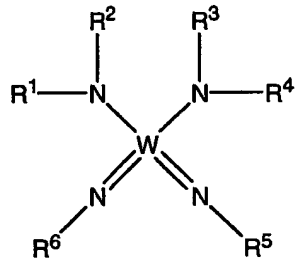
exposing the substrate to the vapor of a second material that activates the surface

so that the surface is prepared to react with additional quantities of said first material; and removing residual vapor of the second material from the vicinity of the substrate.

4. A process as in claim 3 in which said first material comprises one or more compounds comprising tungsten-nitrogen bonds.

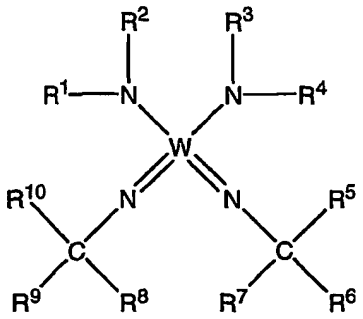
5. A process as in claim 3 in which said first material comprises one or more compounds comprising molybdenum-nitrogen bonds.

6. A process as in claim 4 in which said compounds comprising tungsten-nitrogen bonds have the general formula



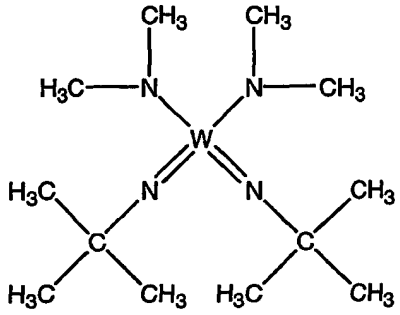
in which R^n represents alkyl groups, arylalkyl groups, alkenylalkyl groups, alkynylalkyl groups, fluoroalkyl groups or alkyl groups substituted with other atoms or groups selected to enhance the volatility of the compound, where R^n is any one of R^1 through R^6 and where the R^n may be the same or different from each other.

7. A process as in claim 4 in which said compounds comprising tungsten-nitrogen bonds have the general formula

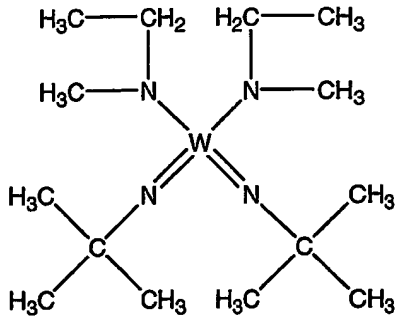


in which R^n represents alkyl groups, arylalkyl groups, alkenylalkyl groups, alkynylalkyl groups, fluoroalkyl groups or alkyl groups substituted with other atoms or groups selected to enhance the volatility of the compound, where R^n is any one of R^1 through R^{10} and where the R^n may be the same or different from each other.

8. A process as in claim 7 in which said compounds comprising tungsten-nitrogen bonds comprise bis(*tert*-butylimido)bis(dimethylamido)tungsten(VI) having the formula



9. A process as in claim 7 in which said compounds comprising tungsten-nitrogen bonds comprise bis(ethylmethylamido)bis(*tert*-butylimido)tungsten(VI) having formula:



10. A process as in claim 3 in which said second material is a Lewis base.

11. A process as in claim 10 in which said Lewis base is ammonia.

12. A process as in claim 10 in which said Lewis base is pyridine

13. A process as in claim 3 in which said second material comprises a hydrogen plasma.

14. A process as in claim 3 in which said second material comprises hydrogen atoms

15. A process as in claim 3 in which the substrate is maintained at a temperature in the range of about 200 °C to about 400 °C.

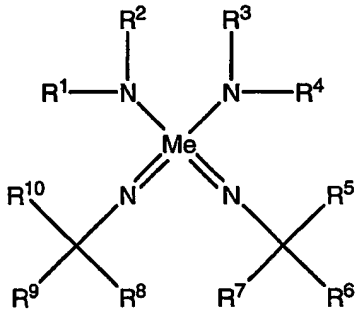
16. An electrical capacitor comprising one or more electrically conducting electrodes formed using the process of claim 1 or 6.

17. A barrier to diffusion of metals in microelectronic devices formed by the process of

claim 1 or 6.

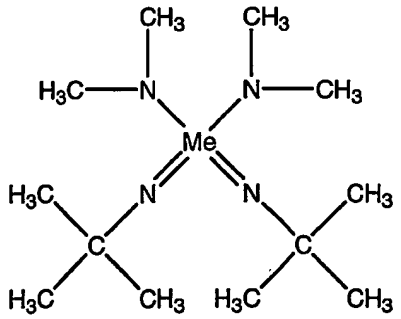
18. The diffusion barrier of claim 17 having a thickness within the range 1 to 100 nm.

19. A composition of matter corresponding to the chemical compound described by the formula



in which Me is W or Mo, R^n represent alkyl groups, arylalkyl groups, alkenylalkyl groups, alkynylalkyl groups, fluoroalkyl groups or alkyl groups substituted with other atoms or groups selected to enhance the volatility of the compound, where R^n is any one of R^1 through R^6 and the R^n may be the same or different from each other.

20. A composition of matter corresponding to the chemical compound described by the formula



in which Me is W or Mo.

21. The composition of claim 19 or 20, wherein Me is W.

22. A process for depositing material from a vapor phase comprising contacting the compound of claim 19 or 20 to a surface.

23. A microelectronic device comprising copper features, said device characterized in that a layer of tungsten nitride deposited according to the process of claim 3 or 6 is interposed between the device substrate and the copper feature.